

# DONGHYEON KANG

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## **CURRENT POSITION**

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**Argonne National Laboratory**  
Postdoctoral Researcher in Applied Materials Division (AMD)

## **RESEARCH INTERESTS**

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Lithium metal batteries	Multi-valent metal battery systems	All solid-state batteries
Solar hydrogen generation	Solar cells	Electrocatalysts
Electrodeposition	(photo)electrochemistry	In situ spectro-electrochemistry

## **EDUCATION**

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**University of Wisconsin – Madison** Madison, WI  
Ph.D. Materials Chemistry (Advisor: Prof. Kyoung-Shin Choi) May 2016  
Dissertation: Studies on electrochemically constructed n- and p-type photoelectrodes for use in solar energy conversion

**Purdue University** West Lafayette, IN  
Ph.D. student, Inorganic Chemistry (Advisor: Prof. Kyoung-Shin Choi) 2012  
Transferred to University of Wisconsin – Madison

**Sogang University** Seoul, Korea  
M.S. Inorganic Chemistry (Advisor: Prof. Nam Hwi Hur) 2010  
Thesis: The synthesis and application of superparamagnetic mesoporous silica balls, Pt-CoFe<sub>2</sub>O<sub>4</sub>@SiO<sub>2</sub>  
B.S. *summa cum laude*, Chemistry 2008

## **RESEARCH EXPERIENCES**

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**Argonne National Laboratory** Lemont, IL  
Postdoctoral Researcher, Applied Materials Division Mar 2018 – Present

- Developing lithium metal electrodeposition process for use in lithium metal battery
- Constructing scale-up process of electrodeposition for Li metal thin film
- In situ Raman analysis of electrochemical process for the next generation batteries

Postdoctoral Researcher, Functional coatings group Aug 2018 – Present

- Functional coatings on battery materials using atomic layer deposition (ALD)
- Electrochemical formation of solid electrolyte interphase layer on Li metal anode
- Investigation on the solid-electrolyte interphase

**LG Chem Research Park**

Senior Researcher, Post Li-ion Battery Project, Center for Future Technology

Seoul, Korea

Jul 2016 – Feb 2018

- Developing lithium metal battery systems
- Developing solid-state electrolytes
- Exploring new electrolytes and additives for use in lithium metal battery

**University of Wisconsin – Madison**

Graduate Researcher (Advisor: Prof. Kyoung-Shin Choi)

Madison, WI

Aug 2012 – May 2016

- Developing electrochemical synthesis routes for a variety of semiconducting materials
- Electrodeposition of various photoelectrodes, electrocatalysts and their integration systems for solar water splitting
- Electrochemical and photoelectrochemical studies of electrocatalysts and photoelectrodes
- Fabrication of p-n junction solid state thin film solar cells

**Purdue University**

Graduate Researcher (Advisor: Prof. Kyoung-Shin Choi)

West Lafayette, IN

Aug 2011 – Jul 2012

- Electrochemical fabrication of homojunction solar cells

**Research Center, Sogang University**

Researcher, Inorganic Materials Synthesis

Seoul, Korea

Mar 2010 – Jul 2011

- Synthesis and characterization of metal oxide and oxynitride photocatalysts

**Sogang University**

Graduate Researcher (Advisor: Prof. Nam Hwi Hur)

Seoul, Korea

Mar 2008 – Feb 2010

- Synthesis of multi-functionalized nanomaterials for use in catalysts

**TEACHING EXPERIENCES**

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**University of Wisconsin – Madison**

• General Chemistry, General Chemistry Laboratory

Madison, WI

Fall 2012 – Spring 2013

**Purdue University**

• Inorganic Chemistry, Inorganic Chemistry Laboratory

West Lafayette, IN

Spring 2012

**Sogang University**

• Inorganic Chemistry, Inorganic Chemistry Laboratory

Seoul, Korea

Spring 2008 – Fall 2009

**HONORS & AWARDS**

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Outstanding Ph.D. student scholarship, *Korea Energy Tech. Evaluation & Plan*

2011 – 2013

Outstanding inorganic chemistry graduate student award, *Sogang University*

2010

Sogang – Maru scholarship, *MARU scholarship foundation*

2008

Dasan scholarship, *DASAN scholarship foundation*

Fall 2007

School honors scholarship, *Sogang University*

Fall 2006

Honors scholarship (AAA), *Sogang University*

Spring 2006

Honors scholarship (AA), *Sogang University*

Fall 2005

**PUBLICATIONS**

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- **Donghyeon Kang**, Dongho Lee, Kyoung-Shin Choi, “Electrochemical Synthesis of Highly Oriented,

Transparent, and Pinhole-Free ZnO and Al-Doped ZnO Films and Their Use in Heterojunction Solar Cells”, *Langmuir*, **2016**, 32, 10459–10466.

- **Donghyeon Kang**, James C. Hill, Yiseul Park, Kyoung-Shin Choi, “Photoelectrochemical Properties and Photostabilities of High Surface Area  $\text{CuBi}_2\text{O}_4$  and Ag-doped  $\text{CuBi}_2\text{O}_4$  Photocathodes”, *Chem. Mater.* **2016**, 28, 4331–4340.
- **Donghyeon Kang**, Tae Woo Kim, Stephen R. Kubota, Allison C. Cardiel, Hyun Gil Cha, Kyoung-Shin Choi, “Electrochemical Synthesis of Photoelectrodes and Catalysts for Use in Solar Water Splitting”, *Chem. Rev.* **2015**, 115, 12839–12887.
- **Donghyeon Kang**, Yiseul Park, James C. Hill, Kyoung-Shin Choi, “Preparation of Bi-Based Ternary Oxide Photoanodes  $\text{BiVO}_4$ ,  $\text{Bi}_2\text{WO}_6$ , and  $\text{Bi}_2\text{Mo}_3\text{O}_{12}$  Using Dendritic Bi Metal Electrodes”, *J. Phys. Chem. Lett.* **2014**, 5, 2994–2999.
- Yiseul Park, **Donghyeon Kang**, Kyoung-Shin Choi, “Marked Enhancement in Electron-Hole Separation Achieved in The Low Bias Region Using Electrochemically Prepared Mo-doped  $\text{BiVO}_4$  Photoanodes”, *Phys. Chem. Chem. Phys.* **2014**, 16, 1238–1246.
- Jongmyung Choi, **Donghyeon Kang**, Kyu Hyung Lee, Byeongno Lee, Kyung Joong Kim and Nam Hwi Hur, “Evidence for Light-Induced Oxygen Exchange in the Oxidation of Liquid Hydrocarbons on Oxygen 18-Labelled Titanium Dioxide”, *RSC Advances*, **2013**, 3, 9402–9407.
- Jung Bo Yoo, Hyo Jin Yoo, Byung Wook Lim, Kang Hyuk Lee, Mi Hyun Kim, **Donghyeon Kang** and Nam Hwi Hur, “Controlled Synthesis of Monodisperse  $\text{SiO}_2$ - $\text{TiO}_2$  Microspheres with a Yolk–Shell Structure as Effective Photocatalysts”, *ChemSusChem* **2012**, 5, 2334–2340.
- **Donghyeon Kang**, Min-Sik Eum, Byeongno Lee, Tae-Sung Bae, Kyu Reon Lee, Heung Bin Lim and Nam Hwi Hur, “Confined Pt and  $\text{CoFe}_2\text{O}_4$  Nanoparticles in a Mesoporous Core/Shell Silica Microsphere and Their Catalytic Activity”, *Bull. Korean Chem. Soc.* **2011**, 32, 3712–3718.
- Byeongno Lee, Seung Hee Kang, **Donghyeon Kang**, Kyu Hyung Lee, Jaeheung Cho, Wonwoo Nam, Oc Hee Han and Nam Hwi Hur, “Isolation and Structural Characterization of the Elusive 1 : 1 Adduct of Hydrazine and Carbon Dioxide”, *Chem. Commun.*, **2011**, 47, 11219–11221.
- Byoung Se Lee, Mihye Yi, So Young Chu, Ja Young Lee, Hye Rim Kwon, Kyu Reon Lee, **Donghyeon Kang**, Wan Seop Kim, Heung Bin Lim, Jouhahn Lee, Hyung-Joong Youn, Dae Yoon Chi, Nam Hwi Hur, “Copper Nitride Nanoparticles Supported on a Superparamagnetic Mesoporous Microsphere for Toxic-Free Click Chemistry”, *Chem. Commun.* **2010**, 46, 3935–3937.
- Kyu Reon Lee, Sol Kim, **Dong Hyun Kang**, Jong In Lee, Yoon Jie Lee, Wan Seop Kim, Deug-Hee Cho, Heung Bin Lim, Jungho Kim, Nam Hwi Hur, “Highly Uniform Superparamagnetic Mesoporous Spheres with Submicrometer Scale and Their Uptake into Cells”, *Chem. Mater.* **2008**, 20, 6738–6742.

#### **PRESENTATIONS IN CONFERENCES & MEETINGS**

- **Donghyeon Kang**, James C. Hill, Yiseul Park, Kyoung-Shin Choi, “Electrochemical Synthesis of High Surface Area p-type  $\text{CuBi}_2\text{O}_4$  and Its Application to Solar Energy Conversion”, *Gordon Research Conference – Electrodeposition and Applications*, Jul. 29, **2014**, Biddeford, ME, USA
- **Donghyeon Kang**, James C. Hill, Yiseul Park, Kyoung-Shin Choi, “Dendritic  $\text{CuBi}_2\text{O}_4$ : A Promising

Photocathode for Water Reduction”, *CCI Solar Fuels Annual Meeting*, Jan. 25, **2014**, Newport, CA, USA

- **Donghyeon Kang**, Yiseul Park, Kyoung-Shin Choi, “Improved Water Oxidation Performances with Mo-doped BiVO<sub>4</sub>/FeOOH Photoanodes”, *CCI Solar Fuels Annual Meeting*, Jan. 26, **2013**, Newport, CA, USA
- **Donghyeon Kang**, Min-Sik Eum, Seung Hyun Han, Nam Hwi Hur, “Proximity effect in Pt and CoFe<sub>2</sub>O<sub>4</sub> nanoparticles confined within the mesoporous shell of a silica microsphere”, *240<sup>th</sup> American Chemical Society National Meeting & Exposition*, Aug. 22, **2010**, Boston, Massachusetts, USA
- **Donghyeon Kang**, Yoon Ji Lee, Seo Young Kim, Min-Sik Eum, Mi Sun Jung, Kyu Reon Lee, Jong In Lee, Nam Hwi Hur, “Novel Metal Catalysts Supported on Superparamagnetic Silica Spheres”, *104<sup>th</sup> Annual Meeting of the Korean Chemical Society*, Oct. 28, **2009**, Daejeon, Korea
- **Donghyeon Kang**, Kyu Reon Lee, Mi Hye Lee, Mi Sun Jung, Jong In Lee, Min-Sik Eum, Yoon Jie Lee, Seo Young Kim, Nam Hwi Hur, “Incorporation of Spinel Ferrites Nanoparticles into Mesoporous Silica Spheres with Submicron Scale”, *238<sup>th</sup> American Chemical Society National Meeting & Exposition*, Aug. 18, **2009**, Washington DC, USA

### **SELECTED PATENT APPLICATIONS**

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- Eunkyung Park, Min-Chul Jang, **Donghyeon Kang**, Byoung Kuk Son, Bora Jung, Jeonghun Choi, “Lithium Secondary Battery”, Korea Patent Application No. 2018-0070931, June 20, 2018.
- **Donghyeon Kang**, Changhun Park, Min-Chul Jang, Doyeon Kim, Se Ho Park, Dayoung Sung, “Electrolyte Plating Solution for Lithium Metal and Method for Preparing Lithium Metal Electrode”, Korea Patent Application No. 2018-0038063, April 02, 2018 // PCT Application No. PCT/KR2018/003951, Apr 04, 2018.
- Byoung Kuk Son, Byoung Gon Kim, Jang Wook Choi, **Donghyeon Kang**, Eunkyung Park, Min-Chul Jang, Jeonghun Choi, “Electrode and Lithium Secondary Battery Comprising the Same”, Korea Patent Application No. 2018-0030476, March 15, 2018 // PCT Application No. PCT/KR2018/003074, March 16, 2018.
- Eunkyung Park, Byoung Gon Kim, Jang Wook Choi, Min-Chul Jang, **Donghyeon Kang**, Byoung Kuk Son, Jeonghun Choi, “Structure”, Korea Patent Application No. 2018-0030410, March 15, 2018 // PCT Application No. PCT/KR2018/003077, March 16, 2018.
- **Donghyeon Kang**, Min-Chul Jang, Eunkyung Park, Changhun Park, Byoung Kuk Son, Jeonghun Choi, “Method for Preparing an Electrode”, Korea Patent Application No. 2017-0078025, June 20, 2017.
- Byoung Kuk Son, Min-Chul Jang, Jeonghun Choi **Donghyeon Kang**, Eunkyung Park, Suk Il Youn, Bora Jung, “Negative electrode for Lithium secondary battery, preparation method and Lithium secondary battery comprising the same”, Korea Patent Application No. 2017-0052748, April 25, 2017 // PCT Application No. PCT/KR2018/004123, April 09, 2018.
- Byoung Kuk Son, Min-Chul Jang, **Donghyeon Kang**, Changhun Park, Suk Il Youn, Jeonghun Choi, “Sodium negative electrode and sodium secondary battery comprising the same”, Korea Patent Application No. 2017-0035776, March 22, 2017.